PRELIMINARY PUBLIC HEALTH ASSESSMENT

HORSESHOE ROAD

SAYREVILLE, MIDDLESEX COUNTY, NEW JERSEY

CERCLIS NO. NJD980663678

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Prepared by:

New Jersey Department of Health
Under Cooperative Agreement with the
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SUMMARY

The Horseshoe Road site is an area of approximately 15 acres located on Horseshoe Road near the Raritan River in northern Sayreville, Middlesex County, New Jersey. The site consists of distinct areas that have been grouped together and are considered one site on the National Priorities List (NPL). These areas include: (1) **Atlantic Resources**, which also includes The Horseshoe Road Dump area; (2) **Atlantic Development**; and (3) **The Sayreville Pesticide Dump**. Numerous owners have disposed of waste materials indiscriminately throughout the area for at least the years between 1972 and 1985.

Studies of soil contamination at the Horseshoe Road site were conducted by the USEPA. Results of the chemical analysis of these soil samples indicate that the sampled area was heavily contaminated with a wide variety of VOC's, phenols, PAH's, pesticides, PCB's, and inorganic compounds, including metals.

The heaviest contamination appears to be closer to the buildings and inside the fences. There is, however significant areas of contamination outside restricted areas. Of particular concern in these accessible areas are: PCB's (660 ppm); pesticides, eg., DDD (160 ppm), DDT (450 ppm), aldrin (190 ppm), endosulfan (380 ppm), and heptachlor (18 ppm); PAH's, eg., benzo(g,h,i)perylene (350 ppm); and metals, e.g., arsenic (1,971 ppm), chromium (2,900 ppm), and lead (471 ppm).

Although there are presently no completed human exposure pathways at the site, trespassers constitute a potential exposure pathway.

Because the aforementioned contaminated areas are outside of the two fenced in zones, it is possible that site trespassers, such as hunters, would be exposed to contaminated areas of the site, particularly of the western edge of the site and the Horseshoe Road Dump section. These are areas of documented soil contamination and potentially contaminated surface water flows off the site through these unsecured areas. Exposures could occur following direct skin contact with contaminated soil or through inhalation of dust created by vehicles, particularly during dry weather. Based on available information, recurrent trespassers at the site are not likely to be exposed to contamination at concentrations sufficient to constitute a public health hazard.

The full extent of the surface soil (0-3"), sediment, and surface water contamination in the area has not been delineated; contamination may extend into "off-site" soils.

All residents and businesses in the area are currently connected to municipal water supply, however, the use of potentially contaminated groundwater for non-potable domestic or industrial purposes is not known and may represent a potential health risk. The existence and location of private wells, which may be influenced by the site, should be confirmed and their potential for contamination reviewed, if necessary.

Although no data were available on surface water and sediment contamination, is likely the site is and has caused the release of site related contaminants to the Raritan River. The site may contribute to an overall degeneration of water quality and biota contamination of the Raritan River in the region of the site.

On the basis of the information reviewed, the ATSDR and NJDOH have concluded that the Horseshoe Road Site currently constitutes an indeterminate public health hazard. Except for the comprehensive study of the on-site surface soil, there are no other significant environmental data available to make a determination as to the existence of currently completed human exposure pathways. The ATSDR's Health Activities Recommendation Panel has reviewed this preliminary public health assessment and has determined that no follow-up health activities are indicated at this time. However, the panel did recommend that further access restrictions be placed around contaminated areas to prevent any potential exposures to trespassers. The NJDOH conducted a comment period for the Preliminary Public Health Assessment from September 23, 1994 to October 28, 1994.

BACKGROUND

A. Site Description and History[1]

The Horseshoe Road site is an area of approximately 15 acres located on Horseshoe Road near the Raritan River in northern Sayreville, Middlesex County, New Jersey (Figure 1 and 2). The site itself is remote however, the area around the site is densely populated and includes residential, business, commercial and industrial areas.

The site consists of four distinct areas that have been grouped together and are considered one site on the National Priorities List (NPL). They are considered one site because: (1) while the areas were not necessarily part of the same operation, the potentially responsible parties (PRP's) likely shared the use of the dump areas; (2) contamination is threatening the same groundwater, surface water, and air, and; (3) they are no more than about 1,000 feet apart.

For the purpose of conducting a Pre-Remedial Investigation the New Jersey Department of Environmental Protection and Energy (NJDEPE) has broken the site into three sub-areas due to past practices and on geographic location. These areas include the following: (1) **Atlantic Resources**, which also includes The Horseshoe Road Dump area; (2) **Atlantic Development**; and (3) **The Sayreville Pesticide Dump**.

(1) Atlantic Resources[1,2]

Located at the end of Horseshoe Road, the Atlantic Resources Corporation conducted various industrial operations from 1972 to August, 1985, including: solvent reclamation; hazardous waste incineration; and precious metal recovery (Figure 3). Between 1968 and 1972, the International Recycling Company conducted similar operations at the site. Operations at the Atlantic Resources site ended in 1985 soon after 2,3,7,8 TCDD (Dioxin) was found on the property by NJDEPE.

In an area on the west side of Atlantic Resources known as The Horseshoe Road Dump (Figure 4), is a filled area where it is suspected that drums were/remain buried. The Middlesex County Utilities Authority (MCUA) installed a forced sewer main which cuts through the site near the dump. While the MCUA was digging their trench, they discovered numerous drum fragments. They also noted a strong organic/ester type odor, and the soil and groundwater was very acidic (pH = 2.0).

Included in the Horseshoe Road Dump area is a drainage swale to the northwest, and a wooded knoll which lies to the northeast.

Chemical analysis of drum samples taken from the Horseshoe Road Dump, showed the presence of lead, chromium, cadmium, phenols, phthalates, PCB's, pesticides, acetonitrile and silver cyanide.

There is some documentation that another company, Brodun Chemical, operated on the site in the early 1970's, and may have dumped ammonia into three lagoons.

In addition to precious metal recovery by means of incineration, Atlantic Resources received printed circuit boards, casting sweeps and fines for metal reclamation and refining. Fourteen "reverse platers" were used to dip circuit boards in a sodium cyanide acid baths to release metals into solution. The metals were smelted into ingots.

Employee documentation, collected by NJDEPE, revealed that Atlantic Resources workers were directed by the company president to : (1) dump drums of unknown materials into the Raritan River; (2) dump drums of potassium cyanide, nitric, muriatic, and hydrochloric acid, and 30% hydrogen peroxide into the wooded area behind Horseshoe Road; and (3) strip gold and silver with nitric acid at night so that area residents and enforcement agencies would not be alerted by the toxic "ruby red fumes" that are emitted by the process.

The U.S. Environmental Protection Agency (USEPA) began limited remediation at the site in early 1987. Remedial activities at the site have included: drum and storage tank removal; laboratory chemical removal; and the covering of Dioxin contaminated soil. This section of the site was also stabilized by repairing and adding barbed wire to the fence.

(2) Atlantic Development[1,3]

The Atlantic Development area is comprised of three buildings (referred to as: Atlantic Development; Sayreville Compounding; and Clover Chemical), and numerous storage tanks (Figure 4). Between the years 1965 and 1981, many companies have conducted a variety of operations at these sites. These operations have included the businesses of: chemists, druggists, drysalters, oil and color men; importers and manufacturers of pharmaceutical, dental, medicinal, chemical, industrial, and insecticidal products; and other preparations and articles, compounds, cements, oils, paints, pigments and varnishes. In addition, some companies operating at the Atlantic Development area produced; polymers and resins, dyes,roofing materials (using coal tar and asbestos); sealants and feedstock products.

There are open floor drains leading from these buildings that terminate in the wetlands to the west. There is documentation which indicates that hazardous materials have been discharged to the wetlands via these drains. It is also suspected that there are underground storage tanks at various locations on the Atlantic Development property. Scattered drums can be found throughout the site and there are numerous 1-10 gallon pails strewn over the property. There are approximately 7-10 above ground storage tanks distributed throughout the area.

Removal activities, in the Atlantic Development area, were initiated by USEPA in October, 1991. These activities involved initial site stabilization which included: containment of surficial contamination; container staging, inventory and sampling; and submission of these samples for

analysis. Containers and drums were staged in the facility buildings. Metal pails and empty drums were crushed and placed in roll-offs. In August, 1992 most of these materials were shipped off-site to an approved disposal site.

(3) The Sayreville Pesticide Dump[1,4]

The last of the three site sub-sections is located at the southern end of Horseshoe Road and is referred to as the Sayreville Pesticide Dump (Figure 4). This name appears to be a misnomer because there has never been any evidence of pesticide dumping in this area.

The Sayreville Pesticide Dump is situated in a wooded area just south of Clover Chemical. The dump contains numerous exposed, partially buried and completely buried drums. There are also piles of a tar-like substance and many areas along the fill are comprised of an unknown gelatinous substance. Waste disposal in this area began in the 1960's and continued through the early 1980's.

The volume of the dump has been estimated to be about 50,000 square feet. This figure may be considerably underestimated because the entire perimeter of the dump has not been delineated. A fence encloses the majority of the visible dump, however there is evidence of dumping beyond the fence, e.g. drum skeletons, tar-like piles, laboratory jars, gloves etc.

As of this writing, the USEPA is mobilizing for their remedial activities at the Sayreville Pesticide Dump. No other previous removal activities have been preformed in this area except for the fence that surrounds the dump, which was installed during remedial work at the Atlantic Development Facility in 1985.

ATSDR Involvement[5]

On August 16, 1991, the ATSDR performed a health consultation at the Horseshoe Road site. The consultation followed a request by the USEPA to comment on the health concerns posed by the existing conditions at the site and to comment on the USEPA's proposal that additional site characterization was necessary.

After analyzing all of the information and data available for the Horseshoe Road site the ATSDR noted that chemically contaminated soils and debris still exist at the site and that direct access to the contamination by local children and other residents was feasible. The report mentioned several substances (e.g., lead, mercury and pesticides), as posing possible health concerns depending on types of exposures. Several of the compounds identified at elevated concentrations are known or suspected carcinogens (e.g., polycyclic aromatic hydrocarbons (PAHs), lindane and dioxin). It was felt that since fishing was permitted in the Raritan River, there existed the additional potential human health concern because some of the contaminants detected on-site (particularly mercury and some

pesticides) may bioaccumulate in fish and other edible marine life, and in some game animals that depend on marine life for their sustenance.

The health consultation made the following conclusions:

1. Current conditions on-site pose a public health threat via direct contact, particularly to youngsters gaining access to the site. The presence of partially filled containers of unknown contents and high levels of lead in soil indicate that relatively brief exposures could result in adverse health effects. Frequent exposures may increase the risk of cancer. A fire and explosion hazard may also exist.

2 Off-site migration may be occurring via surface water runoff, air, and groundwater. Data are insufficient to determine the extent of the health threat. The ATSDR concurs with the USEPA that additional site characterization is necessary.

The health consultation Recommended the following:

1. Restrict access to the site and remove obvious physical hazards.

2. Systematically characterize the site including adjacent areas where migration of contamination is likely.

B. Site Visit

On December 14, 1993, J. Pasqualo and J. Winegar of the New Jersey Department of Health (NJDOH) visited the Horseshoe Road site accompanied by a representative of Roy F. Weston, Inc., the company currently involved in remedial activities at the Sayreville Pesticide Dump section of the site. A representative of the Middlesex County Health Department was also present for the site inspection. The following observations were made during the site visit:

General Comments:

- The Horseshoe Road site appears to be a "run down" industrial area, loosely divided into two major areas: Atlantic Resources, which also includes The Horseshoe Road Dump area; and Atlantic Development, which includes The Sayreville Pesticide Dump.

- The site was remote. There were no occupied residences within 1000 feet of the contaminated areas.

- There were two major fenced in areas, first the Atlantic Resources buildings and tanks and, secondly, the Atlantic Development building complex and The Sayreville Pesticide Dump

which are fenced together. The Horseshoe Road Dump area was not fenced and is accessible to site trespassers.

- The site is "manned" and guarded on a 24 hour basis. In spite of security, trespassing appears to be ongoing and difficult to control. Of particular concern are the activities of hunters and 4-wheel vehicle drivers. Shotgun shells and "fresh" beer cans were noted.

- There were numerous areas of apparent contamination outside of the fenced areas, e.g. drum carcasses, debris, and ground staining.

- Instrument readings (HNU) taken during the site visit did not indicate the presence of organic compounds in the ambient air at detectable levels. (Winds were < 10 knots.)

Atlantic Resources:

- The Atlantic Resources area consisted a large "main building", eight incinerators, bag houses, a ball mill, two above ground storage tanks, and acid vats.

- The main building shows signs of fire damage and a lack of structural integrity.

- The Atlantic Resources area was surrounded by a chain link fence installed by USEPA. The fence appeared to be in good repair and would make trespassing difficult.

- Run-off water from the Atlantic Resources area flows under an access road along a swale directly into the Raritan River.

- West of this drainage swale is the Horseshoe Road Dump. The dump was reportedly covered with relatively clean fill, however, there were numerous visible bits and pieces of circuit board material scattered throughout the dump. There was also several areas of visible soil staining.

Atlantic Development:

- A fence encloses the Atlantic Development site and most of the Sayreville Pesticide Dump. The fence appeared to be in good repair making trespassing difficult.

- Atlantic Development contains three buildings referred to (from north to south) as: Atlantic Development; Sayreville Compounding; and Clover Chemical. Each building shows signs of fire damage and a lack of structural integrity.

- East of the three buildings, and within the fence, there were numerous salvage drums that were staged for future off-site transport.

- Numerous areas of ground staining and surface water sheens were observed.

The Sayreville Pesticide Dump:

- Most of the Sayreville Pesticide Dump lies within the fenced perimeter that surrounds the Atlantic Development site.

- Inside the fenced area there were several large piles of debris and drum carcasses that are partially covered with plastic sheeting.

C. Demographics, Land Use, and Natural Resources Use

In order to evaluate potential health effects associated with exposure to hazardous substances in the environment, NJDOH obtains information on the population in the vicinity of the site ("demographics"), the types of land near the site, and natural resources use in the area. Population information is needed because some types of illness and disease are more common in certain age groups such as the elderly or children, in certain ethnic groups, or in groups of people with low income. In addition, some groups may be more sensitive to the presence of hazardous substances in the environment. Information on educational levels provides NJDOH some guidance on what types of health communication programs may be useful near the site in the future. Land use information is important because sensitive groups of people such as school children or residents of health care facilities may be located near the site. Use of some of the natural resources, such as groundwater, may have an effect on the potential for human exposure to hazardous substances.

Demographics

According to 1990 United States Census data, about 672,000 people live in Middlesex County. The County Planning Board estimates that the population will increase to about 757,000 by the year 2000. About 35,000 people reside in Sayreville

At least 40 residences are located within a one mile radius, and several hundred homes and multi-dwelling buildings are located within two miles. There are no residences within 1000 feet of the Horseshoe Road site.

Land Use[1]

The Horseshoe Road site is a relatively remote area where the land is primarily used for commercial and industrial purposes, although several residences and undeveloped lots are found near the site. The Middlesex County Utilities Authority sewage treatment plant is located northeast of the site. New Jersey Steel, an active manufacturing facility recycling scrap steel, is approximately one-half mile to the southwest.

Except for private gardens, land near the site is not used for agriculture.

There is another EPA Superfund site, the Sayreville Landfill, located approximately 3 miles south and west of the site. The Raritan Arsenal, a federal hazardous waste site, is located just across the Raritan River and within one-half mile northwest of the Horseshoe Road site.

Natural Resources Use[1]

Potable water to the Borough of Sayreville is supplied by the Sayreville Water Company which maintains wells, recharge lagoons and pump mains several miles south of the site. The water company wells range from 300 to 700 feet in depth and draw water from the Old Bridge formation servicing approximately 8,500 people. It has been reported in previous site documents that there are two private wells in the area. It was believed that one of these wells was not in current use due to high salinity. The other well was drawing water from the same Old Bridge formation as the Sayreville municipal well system.

A telephone conversation with the Borough of Sayreville Water Company, (12/6/93), did not confirm the presence of any private wells in the vicinity of the site. They indicated that residences had been connected to the Borough of Sayreville's municipal well system for "many years", possibly since the 1960's. It is not known if some residents are still using residential well water for non-drinking purposes.

Health Outcome Data

There are multiple sources of health outcome data in New Jersey. State and local data for heath outcome information include the New Jersey State Cancer Registry, Birth Defects Registry, Vital Statistics Records, Renal Dialysis Network, and Hospital Discharge Reports. Federal databases such as those maintained by the agencies within the US Department of Health and Human Services (i.e. National Cancer Institute, National Institute for Occupational Safety and Health, and ATSDR) are not site-specific, but may be used for comparison or evaluation purposes.

Cancer might be possible from long-term exposure to one of several of the site contaminants. Please refer to the Toxicological Implications subsection of the Public Health Implications section for more information on cancer.

COMMUNITY HEALTH CONCERNS

In order to gather information on community health concerns, NJDOH spoke with the Middlesex County Health Department and their Environmental Health Division. According to our conversations with these local officials (12/6/9 and 11/22/93, respectively) community concerns have been minimal, possibly due to the site's remoteness and the limited number of residents living near the site. A representative of Middlesex County Environmental Health did mention a past, undocumented,

complaint from an elderly man who stated that he use to walk his dog in the area and that he, the man, was now sick. A similar undocumented complaint was noted by the Middlesex County Health Department. In this case a man had complained about past exposure to the site (playing in the area as a child) causing current health problems. The Middlesex County Health Department was unable to provide any written documentation of these complaints.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The tables in this section list the contaminants of concern. NJDOH evaluates these contaminants in the subsequent sections of the Health Assessment to determine whether exposure to them has public health significance. NJDOH selects and discusses these contaminants based upon the following factors:

- Concentrations of contaminants on and off the site.
- Field data quality, laboratory data quality, and sample design.
- Comparison of on-site and off-site concentrations with health assessment comparison values for (1) noncarcinogenic endpoints and (2) carcinogenic endpoints.
- Community health concerns.

In the data tables that follow under the on-site Contamination subsection and the off-site Contamination subsection, the fact that a contaminant is listed does not mean that it will cause illness or injury if exposures occur. Instead, the list specifies contaminants that will be further evaluated in the public health assessment.

The Data tables include the following acronyms:

- **CREG** = ATSDR Cancer Risk Evaluation Guide
- **EMEG** = ATSDR Environmental Media Evaluation Guide
- **RMEG** = Reference Dose Media Evaluation Guide, calculated from EPA's reference dose (RfD).
- **LTHA** = USEPA's Lifetime Health Advisory
- **NJ MCL** = NJ Maximum Contaminant Level
- **PPB** = Parts Per Billion

- **PPM** = Parts Per Million
- **ND** = Not Detected

ATSDR health assessment comparison values are contaminant concentrations in specific media that are used to select contaminants for further evaluation. These values include Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant guidelines. CREGs are estimated contaminant concentrations based on a one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors. Maximum contaminant levels (MCLs) represent contaminant concentrations that New Jersey or a Federal regulatory agency, eg. EPA, deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of 2 liters of water per day. MCLs are regulatory concentrations. EPA's Reference Dose (RfD) is an estimate of the daily exposure to a contaminant that is unlikely to cause health effects.

The environmental contamination section includes sampling data from a variety of media sources including: groundwater (monitoring wells and residential wells); surface water; surface soil; subsurface soil; and sediments.

A. On-site contamination

Between 1981 and 1993, various samples from an-site environmental media were analyzed. The collection and analysis of the samples were initiated by the NJDEPE and the USEPA.

Soil

In one of the earliest episodes of soil sampling at the Horseshoe Road site, May 1985, the NJDEPE conducted a dioxin investigation at the Atlantic Resources section of the site. Dioxin was detected at concentrations as high as 14.18 ppb.[1] These tests also revealed high concentrations of volatile organic compounds (VOCs), heavy metals, and base-neutral compounds. PCB's were also detected in concentrations ranging from 16 - 27 ppm.

In February, 1989 the United States Environmental Protection Agency (USEPA) conducted a soil investigation at the site (Sayreville Pesticide Dump) which revealed elevated levels of the following contaminants: aluminum, arsenic, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium, zinc, and 1,2,4-trichlorobenzene.[1]

In September 1989 the USEPA authorized additional site investigations, which included some small scale soil sampling which showed extensive contamination. Contaminants identified included: toluene, chloroform, ethylbenzene, 1,2-dichloroethane, nitrobenzene, methoxychlor, arochlor-1254 ...etc.[1]

The first comprehensive studies of soil contamination at the Horseshoe Road site were conducted for Target Compound List (TCL) contaminants, September 23, 1993[6], and for metals, August 28, 1993[7], by the USEPA. The USEPA used surveying equipment to delineate a 50-foot inter-nodal grid system an the site, and surface soil (0-12") samples were taken at the grid axes. Figure 5 shows the location of these samples.

Table's # 1-5 shows the contaminants of concern detected (maximum concentration) in on-site surface soil samples.

Results of the chemical analysis of these soil samples indicate that the sampled area was heavily contaminated with a wide variety of VOCs and phenols (Table # 1), PAH's (Table # 2), pesticides (Table # 3), PCB's (Table # 4), and inorganic compounds (Table # 5), including metals.

Although not specifically noted in the latest soil survey, the NJDEPE, during a 1985 Phase II Dioxin Study, located an area within the fence of Atlantic Resources which had 14.18 ppb 2,3,7,8-TCDD(dioxin) contamination in the soil.[1]

B. Off-site contamination

As noted in the 1991 ATSDR health consultation on the Horseshoe Road site, data concerning off-site contamination was limited, however, there was evidence that off-site migration is occurring[5]. The report noted that toluene was found in the air downwind of the site indicating that other contaminants (e.g., vinyl chloride and other VOCs) may, on occasion be carried, off site. High levels of pesticides and PCBs in sediments in areas of water runoff suggested that contamination of wildlife and fish may be occurring at the site.

The Horseshoe Road site is located less than 200 feet of the Raritan River. According to the USEPA, oil stains found on the site's pipe culvert and drainage ditch which carry runoff water from the site, indicate that contaminants have entered the river. This drainage ditch contains no vegetation and dead animals (e.g. muskrat, rabbit) have been found nearby. The exact cause of the death of these animals was not apparent, but they were suspected to be related to site discharges.

According to the Middlesex County Health Department, oil sheens have been observed at the site on several occasions, at the point where the drainage ditch meets the Raritan River. The extent to which off-site groundwater is contaminated, if at all, can not be determined at this time due to a lack of groundwater data.

C. Quality Assurance and Quality Control

In preparing this Public Health Assessment, ATSDR and NJDOH rely on the information provided in the referenced documents and assumes that adequate quality control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of analysis and

conclusions drawn for this health assessment is determined by the availability and reliability of the referenced information.

D. Physical and Other Hazards

The site contains several physical hazards. On-site buildings are guarded by security personnel, however, any trespassers entering the area would be at great physical risk due to the dilapidated condition of the structures. The perimeter of most of the site is fenced to prevent unauthorized access, but there are areas outside where drum carcasses and other debris have been noted. The rusted and deteriorated condition of some of these materials could cause physical harm and/or injury to trespassers, particularly children. Another source of potential physical harm was noted at the Horseshoe Road Dump area. There were numerous ragged and sharp pieces of circuit board material protruding from the dump.

A geophysical investigation conducted at the site in June 1991 by NJDEPE identified additional hazards.[8] Using magnetic and electromagnetic terrain conductivity techniques they determined that there were three major anomalous areas, possibly indicating the presence of buried drums. One area is the Horseshoe Road dump site west of the Atlantic Resources building, the second is near the southern end of the fence surrounding the Sayreville Pesticide Dump and the third is under the berm south of the Clover Chemical building.

There are no known or suspected radiological or biological hazards associated with the site.

E. Toxic Chemical Release Inventory Data

The NJDOH conducted a search of the Toxic Chemical Release Inventory (TRI) in an attempt to identify any possible facilities that could be contributing to the environmental contamination near the Horseshoe Road Site. The TRI is compiled by USEPA and is based on estimated annual releases of toxic chemicals to the environment (air, water, soil, or underground injection) provided by certain industries.

The TRI search for the years from 1987 to 1990 did not list any reported emissions of chemicals that could contribute to ar be confused with the contamination caused by the Horseshoe Road Site.

PATHWAYS ANALYSIS

To determine whether nearby residents are exposed to contaminants migrating from the site, NJDOH evaluates the environmental and human components that lead to human exposure. This pathways analysis consists of five elements: (1) a **source** of contamination; (2) transport through an **environmental medium**; (3) a **point of human exposure**; (4) **route of human exposure**; and (5) an **exposed population**.

NJDOH classifies exposure pathways into three groups: (1) **"completed pathways"**, that is, those in which exposure has occurred, is occurring, or will occur; (2) **"potential pathways"**, that is, those in which exposure might have occurred, may be occurring, or may yet occur; and (3) **"eliminated pathways"**, that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified. A summary of all the pathways for the Horseshoe Road site and the contaminants of concern summarized in Table 7.

TABLE # 7. POTENTIAL EXPOSURE PATHWAYS

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Residential wells	HRS*	Groundwater	Residences (Taps)	Ingestion, Inhalation, Skin Contact	Residents	Past
HRS Waste Material	HRS	Soil	on-site dumps/ spills	Ingestion, Inhalation, Skin Contact	Tress-passers	Past Present Future**
HRS Waste Material	HRS	Air	on-site dumps/ spills	Inhalation	Tress-passers	Past Present Future**
HRS Waste Material	HRS	Sediment Surface Water	on-site Drainage Swale	Ingestion, Skin Contact	Tress-passers	Past Present Future**
Raritan River (Biota)	HRS	Sediment Surface Water Groundwater	Biota	Ingestion	Consumers of Biota	Past Present Future**

* Horseshoe Road Site
** Pending Remediation

A. Completed Pathways

There are no known completed pathways at the Horseshoe Road Site.

B. Potential Pathways

Residential Well Pathways

It is likely that groundwater under and in the vicinity of the Horseshoe Road Site have been contaminated by the site. Possible contaminants include: VOCs, PAHs, heavy metals (e.g., lead and mercury), and pesticides.

Past exposures of several residents living near the Horseshoe Road Site may have occurred prior to the introduction of a municipal water supply sometime during the 1960's (personal communication, Sayreville Water Company). Current and future exposures are possible for any local residents still using well water for non-drinking purposes such as showers and dishwashing, and through direct contact with VOC's released during activities such as handwashing. Local officials were unable to confirm or deny the possibility that some residential wells might still be in service. Past documents on the site have made reference to at least two of these residential wells within 1/2 mile of the site. Since little is known of the groundwater under the site, the gradient of groundwater has not been characterized. It is assumed, however, that the flow would generally be away from these wells and towards the Raritan River.

Soil Pathways

Soil sampling (0-12") at the Horseshoe Road Site has demonstrated a considerable level of contamination. Numerous contaminants were detected, above ATSDR's comparison values, including VOC's and phenols, PAH's, heavy metals, PCB's and pesticides.

It is important to note that since the soil samples were taken at 50 foot intervals on a grid, they may not be accurate representations of area contamination. Actual contaminant levels may be higher or lower. While calculating exposure doses for soil exposure, the ATSDR prefers to use surface soil taken from the 0 - 3" level. Using soil data from the 0 -12" level is less representative of surface soil exposure, depending on the amount of soil contaminant migration to lower soil levels.

The heaviest contamination at this site appears to be closer to the buildings and inside the fences. There is, however significant areas of contamination outside restricted areas. Of particular concern in these accessible areas are: PCB's (660 ppm); pesticides, eg. DDD (160 ppm), DDT (450 ppm),

aldrin (190 ppm), endosulfan (380 ppm), and heptachlor (18 ppm); PAH's, eg., benzo(g,h,i)perylene (350 ppm); and Metals, e.g., arsenic (1,971 ppm), chromium (2,900 ppm), and lead (471 ppm).

Because the aforementioned contaminated areas are outside of the two fenced in zones, it is possible that site trespassers, such as hunters, would be exposed to contaminants at levels of public health concern. Exposures could occur following direct skin contact with contaminated soil or through inhalation of dust created by vehicles, particularly during dry weather.

On site workers and nearby residents may potentially exposed to airborne soil and dust released during site remediation activities. The number of people who may be potentially exposed to contaminated soil at or near the site is unknown.

Surface Water and Sediments

The site has been heavily contaminated, as documented by a history of spills, poor housekeeping practices, illegal disposal and unpermitted wastewater discharges. As previously noted, surface water runs off the site into the Raritan River. In addition, there is documentation of hazardous chemicals being dumped directly into the river.

No surface water sampling results were available for review, but it would be reasonable to conclude, given the history and conditions of the site, that surface water and sediments of the Raritan River have been adversely effected by the site.

Recreational use, e.g. boating and fishing, in this portion of the Raritan River has been confirmed by the Local Health Department. These types of activities could lead to potential exposures, mostly through dermal contact, to site related contaminants, although it would be unlikely they would be exposed at levels of public health concern.

As part of their justification for requesting a removal action at the Sayreville Pesticide Dump section of the site, the USEPA did some limited sediment sampling in the drainage area leading from this area.[4] These data showed significant contamination with organic compounds and heavy metals, Table # 6.

Biota

Potential past, present, and future exposures to site contaminants that may bioaccumulate in fish, and other aquatic life, is possible for individuals who have eaten or eat fish and/or crustacea from the Raritan River.

Several of the site related contaminants, e.g. lead, mercury, and PCBs, have a moderate to high potential for bioaccumulation in fish. Fish sampling is necessary to eliminate this pathway. Also, since many fish are bottom feeders, they come in close contact with possibly contaminated sediments. This pathway can not be fully evaluated until additional sediment and biota data are available.

PUBLIC HEALTH IMPLICATIONS

A. Toxicologic Evaluation

This section contains discussion of the health effects in persons exposed to specific contaminants, evaluations of State and local databases, and address specific community health concerns. Health effects evaluations are accomplished by estimating the amount (or dose) of those contaminants that a person might come in contact with on a daily basis. This estimated exposure dose is than compared to established health guidelines. People who are exposed for some crucial length of time to contaminants of concern at levels above established guidelines are more likely to have associated illnesses or disease.

Health guidelines are developed for contaminants commonly found at hazardous waste sites. Examples of health guidelines are the ATSDR's Minimum Risk Level (**MRL**) and the USEPA's Reference Dose (**RfD**). When exposure (or dose) is below the MRL or RfD than non-cancer, adverse health effects are unlikely to occur.

MRLs are developed for each route of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (365 days and greater). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status.

The toxicological effects of the contaminants detected in the environmental media have been considered singularly. The cumulative or synergistic effects of mixtures of contaminants may serve to enhance their public health significance. Additionally, individual or mixtures of contaminants may have the ability to produce greater adverse health effects in children as compared to adults. This situation depends upon the specific chemical being ingested or inhaled, its pharmacokinetics in children and adults, and its toxicity in children and adults.

Trespassers on the site

Although there are presently no completed human exposure pathways at the site, trespassers constitute a potential exposure pathway.

The NJDOH has determined that trespassers on the Horseshoe Road site may be exposed to several contaminants at levels of public health significance. It is very unlikely that very young children would trespass on the site, mostly due to the remoteness of the site. It is likely that trespassers would be either adults or older children (≥ 35 Kg). Since site trespassers would be, unlikely to either inadvertently or intentionally come in contact with contamination inside the two fenced areas, the contaminant levels used in this section reflect levels found outside the fenced areas were access is possible.

Because of the large diversity of compounds present, this toxicological evaluation is organized by groups of contaminants (e.g., PCB's) or by a representative compound from a group which presents the highest potential for adverse health effects. In addition, selection of contaminants was also based on the location and concentration found on the site.

To estimate exposure doses of persons hunting and/or trespassing on the site, the following assumptions were made. It was assumed that the site was visited by children (35 kg), 2 times per week, for a period of four months per year, and that they would ingest 200 milligrams (mg) of soil during each visit.

POLYCHLORINATED BIPHENYLS (PCB's)[9]

As reported earlier in this public health assessment, trespassers at the Horseshoe Road site may be exposed to PCB's at a maximum concentration of 660 ppm. The estimated exposure dose is approximately equal to ATSDR's chronic oral MRL of 0.00002 mg/kg/day. Exposure doses were well below the no observed adverse effect levels (NOAELs) for chronic oral exposure in animals (for effects other than cancer), cited in the ATSDR Toxicological Profile for PCB's.

PCB's are carcinogenic in animals and potentially carcinogenic in humans; the USEPA classifies PCB's as a probable human carcinogen. Based upon the maximum concentration of PCB's found in soils outside the fenced areas at the site, the lifetime excess cancer risk (LECR) associated with oral exposure to PCB's would present no apparent risk of cancer.

PAH's - (benzo[g,h,i]perylene)[10]

Trespassers at the Horseshoe Road site may be exposed to benzo(g,h,i)perylene at a maximum concentration of 350 ppm.

Presently there is no MRL or RfD for chronic oral exposure to benzo(g,h,i)perylene. However, exposure doses calculated from the maximum reported concentration of benzo(g,h,i)perylene (350 ppm) were below the No Observed Adverse Effects Level (NOAEL) for animal studies, intermediate exposure (15-365 days) presented in the ATSDR Toxicological Profile for this chemical. At such concentrations, it is not likely that non-carcinogenic adverse health effects would occur.

Several PAH's have been shown that they may reasonably be anticipated to be carcinogens. Benzo(g,h,i)perylene, however, was found by the USEPA to be not classifiable as a human carcinogen.

PESTICIDES (DDT)[11]

Trespassers at the Horseshoe Road site may be exposed to 1,1,1-trichloro-2,2-*bis*(*p*-chlorophenyl)ethane (DDT) at a maximum concentration of 450 ppm. The estimated exposure dose is below USEPA's chronic oral RfD of 0.0005 mg/kg/day. Exposure doses are less than the no observed adverse effect levels (NOAELs) for chronic exposure in animals (for effects other than cancer) cited in ATSDR's Toxicological Profile for this chemical.

Studies have shown that DDT is carcinogenic in animals; the USEPA classifies DDT as a probable human carcinogen. Based upon the maximum concentration found in soils outside the fenced areas at the site and resultant estimated exposure doses, the lifetime excess cancer risk (LECR) associated with oral exposure to DDT presents an insignificant increased risk of cancer.

METALS (arsenic)[12]

Trespassers at the Horseshoe Road site may be exposed to arsenic at a maximum concentration of 1,971 ppm. The estimated exposure dose is below the chronic oral MRL of 0.0003 mg/kg/day. Exposure doses do not exceed the no observed adverse effect levels (NOAELs) for chronic exposure in animals (for effects other than cancer) cited in the ATSDR Toxicological Profile for this element.

Studies have shown that arsenic is a human carcinogen, and is so classified by the USEPA. Based upon the maximum concentration found outside the fenced areas at the site, the lifetime excess cancer risk (LECR) associated with oral exposure to arsenic present an insignificant increased risk of cancer.

B. Health Outcome Data Evaluation

Health outcome data for the Horseshoe Road Site were not evaluated. Although potential exposure pathways for on-site contaminants have existed in the past, primarily through contact with contaminated groundwater, only a few residences were potentially exposed. Available databases would not yield observable results for a study population of this size.

Should the ATSDR and the NJDOH decide to do so, the health status of those residents whose wells were effected by site related contamination may best be determined by individual case investigation.

C. Community Health Concerns Evaluation

Community health concerns at the Horseshoe Road Site have been minimal, possibly due to the sites remoteness and the limited number of residents living near the site.

The ATSDR and the NJDOH will review and evaluate any community health concerns which may arise. Current remedial work at the site and the release of the preliminary health assessment may generate interest among the public during the public comment period. Any comments received will be addressed in a subsequent responsiveness summary.

Public Comment Period

The New Jersey Department of Health (NJDOH) conducted a comment period for the Preliminary Public Health Assessment for the Horseshoe Road site from September 23, 1994 to October 28, 1994. The Preliminary Public Health Assessment was placed in local repositories to facilitate commentary and reaction from the public at large. Additionally, the Public Health Assessment Addendum was circulated to the Middlesex County Health Department for the purpose of soliciting commentary by local health officials.

The NJDOH did not recieve any comments regarding the Horseshoe Road site during this period.

CONCLUSIONS

On the basis of the information reviewed, the ATSDR and NJDOH have concluded that the Horseshoe Road Site currently constitutes an indeterminate public health hazard. Except for the comprehensive study of the on-site surface soil, there are no other significant environmental data available to make a determination regarding completed human exposure pathways.

Areas of the site, particularly of the western edge and the Horseshoe Road Dump section, remain accessible to trespassers. These are areas of documented on-site soil contamination and potentially contaminated surface water flows off the site through these unsecured areas. Based on available information, recurrent trespassers at the site are not likely to be exposed to contamination at concentrations sufficient to constitute a public health hazard.

Health risks can be estimated for the potential exposure pathway associated with a recurrent trespasser at the site. Based upon the maximum concentration found outside the fenced areas at the site, the lifetime excess cancer risk (LECR) associated with oral exposure to PCBs, DDT and arsenic ranged from no apparent to insignificant risk of cancer to recurrent site trespassers, ingesting 200 mg of soil. Similarly, the exposure doses calculated at these concentrations were at the no observed adverse effect levels (NOAELs) for PCBs and below the NOAEL for DDT and arsenic.

The full extent of the surface soil (0-3"), sediment, and surface water contamination in the area has not been delineated; contamination may extend into "off-site" soils.

The site is distant enough from the closest occupied residences (> 1/2 mile) that the proposed remedial activities should not pose a threat to public health.

All residents and businesses in the area are currently connected to municipal water supply. However, the use of potentially contaminated groundwater for non-potable domestic or industrial purposes is not known and may represent a potential health risk. The existence and location of private wells, which may be influenced by the site, should be confirmed and their potential for contamination reviewed, if necessary.

Although no data were available on surface water and sediment contamination, is likely the site is and has caused the release of site related contaminants to the Raritan River. The site may contribute to an overall degeneration of water quality and biota contamination of the Raritan River in the region of the site.

RECOMMENDATIONS

Cease/Reduce Exposure

1. Restrict public access to contaminated areas of the site not presently fenced.

2. Identify all uses of private well water downgradient of the site.

3. Utilization of optimal dust control measures during site remediation is desirable due to the nature and extent of soil contamination.

Site Characterization

The following information is needed to fully and adequately evaluate the public health impact of the Horseshoe Road Site:

1. Additional data for surface soil (0 to 3 inches deep) samples to fully characterize the extent and amount of on-site and off-site contamination.

2. Hydrogeologic investigations to characterize the direction and extent of contaminant migration from the site.

3. Access the contribution of the site to water and biota contamination of the Raritan River.

HEALTH ACTIVITIES RECOMMENDATION PANEL (HARP) RECOMMENDATIONS

The data and information developed in the Public Health Assessment for the Horseshoe Road, Sayreville, New Jersey, site have been evaluated by ATSDR's Health Activities Recommendation Panel (HARP) for appropriate follow-up with respect to health activities. The panel determined that no follow-up health actions are indicated at this time. However, the Panel recommends that further access restrictions be placed around contaminated areas to prevent any potential exposures to trespassers.

PUBLIC HEALTH ACTIONS

The Public Health Action Plan (PHAP) for the Horseshoe Road Site contains a description of the actions to be taken by ATSDR and/or NJDOH at or in the vicinity of the site subsequent to the completion of this Public Health Assessment. The purpose of the PHAP is to ensure that this health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included, is a commitment on the part of ATSDR/NJDOH to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by ATSDR/NJDOH are as follows:

A. Public Health Actions Taken

1. Environmental data and proposed remedial activities have been evaluated within the context of human exposure pathways and relevant public health issues.

B. Public Health Actions Planned

1. ATSDR and the NJDOH will coordinate with the appropriate environmental agencies to develop plans to implement the cease/reduce exposure and site characterization recommendations contained in this health assessment.

2. ATSDR will provide an annual follow up to this PHAP, outlining the actions completed and those in progress. This report will be placed in repositories that contain copies of this health assessment, and will be provided to persons who request it.

ATSDR will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

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12. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Arsenic. Atlanta: ATSDR, April 1993.

APPENDICES

Appendix A - Figures

(Contact the Hazardous Waste Site Project at (609) 984-2193 for a copy of Appendix A)

Appendix B - Tables

Table 1. Maximum Contaminant Concentrations, *VOC's and Phenols*, in on-site surface soil (0-12"), Horseshoe Road Site, September 23, 1993.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
Benzene	1,800 E	1	20	CREG
Chloroform	300	1	100	CREG
1,2-Dichloroethane	66	1	8	CREG
Tetrachloroethene	830	1	10	CREG
Toluene	68,000	1	10000	child RMEG
Trichloroethene	2,000 E	1	60	CREG
Vinyl Chloride	12 J	1	1	child EMEG
2,3,4,6-Tetrachlorophenol	3,200	1	2000	child RMEG
2,4,-Dinitrophenol	830 J	1	200	child RMEG
2,4,6-Trichlorophenol	170	1	60	CREG
2,4-Dichlorophenol	4,000	1	200	child RMEG
Nitrophenols	3,200	1	NA	NA
4,6,-Dinitro-2-methylphenol	1,400	1	NA	NA
4-Chloro-3-methylphenol	850	1	NA	NA
O-Cresol	600 J	1	NA	NA
Pentachlorophenol	3,400	1	6	CREG

KEY:

NA- Not Available

E- Exceeds calibration range of the GC instrument for the specific analysis. The compound can be considered to be present in significant concentrations.

J- Estimated concentration; the identity or associated numerical value may not accurately reflect the identity or amount present in the environmental sample.

Table 2. Maximum Contaminant Concentrations, *PAH's*, in on-site surface soil (0-12"), Horseshoe Road Site, September 23, 1993.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
Acenapthene	21,000	1	3000	child RMEG
Anthracene	41,000 E	1	2000	child RMEG
Benzo(a)anthracene	30,000 E	1	NA	NA
Benzo(a)pyrene	8,100	1	0.1	CREG
Benzo(b)/(k)fluoranthene	24,000 E	1	NA	NA
Benzo(g,h,i)perylene	3,600	1	NA	NA
Chrysene	12,000	1	NA	NA
Dibenz(a,h)anthracene	4,100	1	NA	NA
Fluoranthene	21,000 E	1	2000	child RMEG
Fluorene	30,000	1	2000	child RMEG
Indeno (1,2,3-cd) pyrene	5,200	1	NA	NA
Naphthalene	2,100	1	NA	NA
Phenanthrene	26,000 E	1	NA	NA
Pyrene	37,000 E	1	2000	child RMEG

KEY:

NA- Not Available

E- Exceeds calibration range of the GC instrument for the specific analysis. The compound can be considered to be present in significant concentrations.

J- Estimated concentration; the identity or associated numerical value may not accurately reflect the identity or amount present in the environmental sample.

Table 3. Maximum Contaminant Concentrations, *Pesticides*, in on-site surface soil (0-12"), Horseshoe Road Site, September 23, 1993.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
4,4'-DDD	210 E	1	3	CREG
4,4'-DDE/Dieldrin	110 E	1	2	CREG
4,4'-DDT	450 E	1	2	CREG
Aldrin	200 E	1	0.04	CREG
Alpha-BHC	420 E	1	0.1	CREG
Alpha/Gamma-Chlordane	290 E	1	0.5	CREG
Beta-BHC	3.1	1	0.4	CREG
Delta-BHC	580 E	1	NA	NA
Endosulfan I/II	740 E	1	100	child EMEG
Endosulfan Sulfate	1,100 E	1	NA	NA
Endrin	260 E	1	20	child EMEG
Endrin Aldehyde	440 E	1	NA	NA
Endrin Ketone	370 E	1	NA	NA
Gamma-BHC (Lindane)	970 E	1	20	child RMEG
Heptachlor	2700	1	0.2	CREG
Heptachlor Epoxide	160 E		0.08	CREG
Methoxychlor	1,600,000 E		300	child RMEG

KEY:

NA- Not Available

E- Exceeds calibration range of the GC instrument for the specific analysis. The compound can be considered to be present in significant concentrations.

J- Estimated concentration; the identity or associated numerical value may not accurately reflect the identity or amount present in the environmental sample.

Table 4. Maximum Contaminant Concentrations, *PCB's*, in on-site surface soil (0-12"), Horseshoe Road Site, September 23, 1993.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
Aroclor-1016	1,200 E	1	4	child RMEG
Aroclor-1221	16,000	1	0.09	CREG
Aroclor-1248	8,800	1	0.09	CREG
Aroclor-1254	2,000 E	1	0.09	CREG
Aroclor-1260	89,650	1	0.09	CREG

Table 5. Maximum Contaminant Concentrations, *Metals*, in on-site surface soil (0-12"), Horseshoe Road Site, August 28, 1993.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
Arsenic	1,971	2	0.4	CREG
Cadmium	601	2	40	child EMEG
Chromium-total	6,561	2	300[a]-50,000[b]	child RMEG
Copper	16,255	2	NA	NA
Lead	11,100	2	NA	NA
Mercury	1,440	2	NA	NA
Nickel	6,892	2	1000	child RMEG
Selenium	144	2	100	child EMEG
Silver	2,295	2	300	child RMEG

KEY:
NA- Not Available
a - RMEG for Chromium +6
b - RMEG for Chromium +3

Table 6. Maximum Contaminant Concentrations, *VOC's, PAH'S, PCB'S AND PESTICIDES*, on-site Sediment samples, Horseshoe Road Site (Sayreville Pesticide Dump) 1991.

Contaminant	Maximum Concentration (ppm)	Ref.	Comparison Value	
			(ppm)	Source
Aroclor-1254	3.0 E		0.09	CREG
Benzo(b)fluoranthene	1.2		NA	NA
Benzo(a)pyrene	1.2		0.1	CREG
Bis(2-ethylhexyl)phthalate	3.3 E		NA	NA
Chloroform	2.1		100	CREG
Methoxychlor	18,000 E		300	child RMEG
Phenanthrene	30.0 E		NA	NA

KEY:

NA- Not Available

E- Exceeds calibration range of the GC instrument for the specific analysis. The compound can be considered to be present in significant concentrations.

J- Estimated concentration; the identity or associated numerical value may not accurately reflect the identity or amount present in the environmental sample.

Appendix C - ATSDR Health Consultation

(Contact the Hazardous Waste Site Project at (609) 984-2193 for a copy of Appendix C)